

# CMSC 479/679

## Fall 2014



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# My Research Topics

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## ◆ Robotics

- ◆ How can we go from industrial robots to useful robots in human environments? (Schools, cars, homes...)

## ◆ Natural Language Processing

- ◆ How can computers learn to understand and speak human languages (English)?

## ◆ Artificial intelligence

- ◆ How to get computers to behave in ways that we would consider to be “intelligent”

## ◆ Human-Robot Interaction (HRI)



# Today's Class

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- ◆ Introduction and goals
- ◆ Review of syllabus and schedule
- ◆ Academic honesty policy
- ◆ Expectations
- ◆ Topics we'll cover
- ◆ What is a robot?



# Goals of This Course

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- ◆ Provide an overview of big problems in robotics
- ◆ Understand the elements of a robot system
- ◆ Get hands-on experience with robot software, hardware, and problem-solving
- ◆ Understand what robots can do now, could do better, and will be doing in future





# Classroom Policies

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- ◆ Be courteous to classmates and instructors.
- ◆ No devices in use except when specified.
  - ◆ You don't learn as much.
    - ◆ Yeah, no, you really don't.
  - ◆ People around you don't learn as much.
  - ◆ <http://tiny.cc/devices-in-class>
- ◆ Don't eat in the classroom.
  - ◆ Distracting to everyone.



# Syllabus

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- ◆ <http://tiny.cc/robotics-syllabus>
  - ◆ Links to schedule
  - ◆ Coursework, grading, and policies
- ◆ Office hours:
  - ◆ Monday 9:00-10:00pm,
  - ◆ Tuesday 10:00-11:00am
  - ◆ By appointment.
- ◆ Lab hours: **TBD**
- ◆ TA: Nisha Pillai

Write this  
down, it's  
important!



# Grading

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Class participation	10%
Team participation	5%
Homework	20%
Quizzes	5%
Projects	50%
Final exam	10%
Extra credit	(up to) 3%



# Assignment Policies

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- ◆ This class is primarily *paperless*.
- ◆ Most assignments will be turned in electronically
  - ◆ Blackboard, online forms, or email
  - ◆ 10% penalty for failing to follow turn-in instructions
- ◆ Usually due at 11:59pm the day before class
  - ◆ Late: 20% off per day
- ◆ Time management
  - ◆ Extensions are sometimes available
  - ◆ Please talk to me!



# Teamwork

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- ◆ Projects will be done in teams of 4-5
- ◆ Teams will be assigned based on skills and interests
  - ◆ <http://tiny.cc/robotics-survey-1>
- ◆ Teams will:
  - ◆ Meet regularly
  - ◆ Do in-class *and* out-of-class group assignments
  - ◆ Share effort on project elements reasonably
  - ◆ Occasionally describe who's doing what



# Academic Integrity

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- ◆ I hate policing students, and I hope not to have to do so.
  - ◆ But, it is extremely unfair to the other students, so...
- ◆ *I take integrity very seriously.*
  - ◆ **Fabrication:** Fabricating sources or any other information in your assignments is academically dishonest.
  - ◆ **Aiding and abetting:** Providing another student with answers, or helping them to cheat.
  - ◆ **Plagiarism:** Using a source (for code, blocks of text, images, or designs) without appropriate citations and recognition.
  - ◆ **Copying:** Using another student's work for an assignment, exam, or project without acknowledgment.
- ◆ You can do a LOT of collaboration in this class!



# Integrity and Teamwork

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- ◆ 50% of your grade in this class involves teamwork.
- ◆ How can teamwork be unethical?
  - ◆ Not sharing the workload evenly
  - ◆ Not contributing to the group
  - ◆ Misrepresenting who did what
  - ◆ Working together on individual assignments
- ◆ Falsely claiming someone contributed to the group.

**Don't make me handle a cheating case.**



# Expectations

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- ◆ Attend class regularly
  - ◆ If you will miss class for a good reason (work commitment, religious holiday, serious illness), drop me an email in advance
- ◆ Complete the assigned reading before coming to class
  - ◆ Class participation is hard otherwise!
- ◆ Participate
  - ◆ Participate actively in class discussions
  - ◆ Let other people participate, and listen attentively
  - ◆ Ask questions!
  - ◆ Read and post to the forum





# Projects

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- ◆ Several broad areas are possible
  - ◆ E.g., perception, robot building, manipulation, HRI, ...
- ◆ Team-based
- ◆ Will (almost certainly) not all be the same
  - ◆ Your team will come up with 2-3 ideas and meet with me
  - ◆ I will provide ideas and examples
- ◆ Will be broken down into milestones, reports, demos, and final presentation
- ◆ We'll all know more Tuesday!



# Communications

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- ◆ For help:
  - ◆ Post to the forum (if appropriate)
  - ◆ Come to office hours
  - ◆ Drop by ITE 331
  - ◆ Email the instructor
  - ◆ Email the TA (if appropriate)
- ◆ Email:
  - ◆ 24-hour cooling period
  - ◆ *Email must include a link to your forum post.*



# Communications

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- ◆ Developing this class is an ongoing project.  
*I genuinely value your continual input!*
- ◆ Suggestions/criticisms/complaints/compliments?

Policies	Assignments	Grading
Course Structure	Workload	Groups
In-class Activities	Topics	Readings

- ◆ How?
  - ◆ Post on the forum, email me directly, email/talk to Nisha, slip a note under my door, smoke signals, ...



# General Topics

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- ◆ Overview and Concepts
- ◆ Sensing
- ◆ Actuators
- ◆ Control software
- ◆ Motors/motor control
- ◆ Locomotion
- ◆ Manipulation
- ◆ Kinematics
- ◆ Localization
- ◆ Motion planning
- ◆ Machine learning
- ◆ Hardware Design
- ◆ Cognition
- ◆ Human-robot interaction



# For Next Class

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- ◆ Read the academic integrity page
- ◆ Read the syllabus
  - ◆ <http://tiny.cc/robotics-syllabus>
- ◆ Make sure the schedule makes sense
- ◆ Fill out the course survey
  - ◆ <http://tiny.cc/robotics-survey-1> (posted 8/28)
- ◆ Read S&N Chapter 1

# Familiar Robots

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Sentinel. X-Men,  
Days of Future Past:  
2014



ED-209. Robocop:  
2014



Wall•E: 2008



Data. Star Trek: TNG: 1987



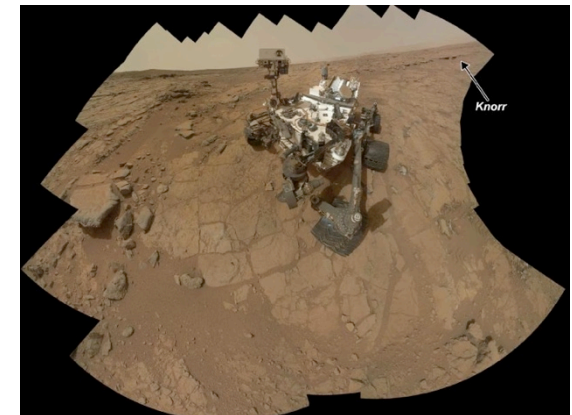
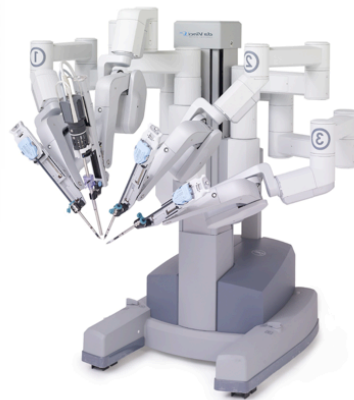
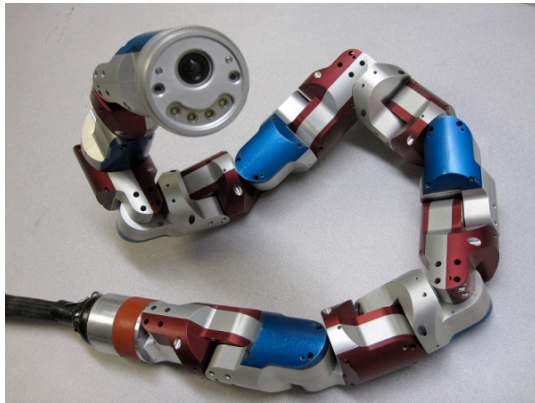
Optimus Prime.  
Transformers: 2007-current



# Some 21st century robots



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# What is a Robot?

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“A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.” (Robot Institute of America)

- ◆ Autonomous?
- ◆ Physical?
- ◆ Human-friendly?
- ◆ Humanoid?
- ◆ Sensory?
- ◆ Intelligent?
- ◆ Mobile?
- ◆ Manipulative?
- ◆ What else?



# Robots Up to Now

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- ◆ Robots now:
  - ◆ Expensive
  - ◆ Complex
  - ◆ Special-purpose
- ◆ Environments
  - ◆ Dedicated
  - ◆ Constrained
- ◆ Use and Management
  - ◆ Controlled by trained experts
  - ◆ Slow and expensive to reconfigure/repurpose



# Robots Now

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- ◆ As technology improves:
  - ◆ Smaller
  - ◆ Cheaper
  - ◆ More broadly capable
- ◆ Can consider deploying in human-centric environments
  - ◆ Homes
  - ◆ Schools
  - ◆ Care facilities
- ◆ Requires: flexibility and human-robot interaction (HRI).





# What *Should* They Do?

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- ◆ Robots are moving away from factory floors to...
  - ◆ Entertainment, toys
  - ◆ Homes (personal robotics)
  - ◆ Medical, surgery
  - ◆ Industrial automation (mining, harvesting, warehouses, ...)
  - ◆ Hazardous environments (space, underwater, battlefields, ...)
  - ◆ Roads
- ◆ Research Trends
  - ◆ Manipulation of everyday objects
  - ◆ Complex household tasks
  - ◆ Object recognition, mapping, interaction
  - ◆ Human robot interaction



